THE ROLE OF PRIOR EXPERIENCE WHEN LEARNING ONLINE: ITS EFFECTS ON ENGAGEMENT AND INTEREST OVER TIME

by

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STATEMENT OF DISSERTATION APPROVAL

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ABSTRACT

Research suggests that the assignment of utility-value to an activity can have positive effects on motivation to engage in that activity. When prior experience with a task is also taken into consideration, positive effects of utility-value information were found for both experienced and inexperienced students. These effects have yet to be examined in evaluative contexts (e.g., the classroom). The present study examined the moderating effects of prior experience on utility-value, in contexts where performance may be important. The role of gender was also examined. Study 1 brought college students (n = 279) to the lab to participate in a 90-minute lesson where they were randomly assigned to either receive or not receive information about how HTML programming could be useful (utility-value). Results suggest that participants who had prior experiences with webpage creation, who were also forewarned about the quiz, had greater anticipated interest in the lesson material, which subsequently predicted greater engagement with lesson material and postlesson interest. For participants who did not have prior experience, knowing that there would be a quiz at the end of the lesson negatively predicted engagement and postlesson interest. The addition of utility-value negatively affected postlesson quiz score for participants who were forewarned about the quiz at the end of the lesson. Study 2 examined students (n = 73) over the course of a semester-long, online introduction to webpage creation course. Students were randomly assigned to receive or not receive utility-value information at the beginning of each of four sections of the course. Results revealed that those students in the utility-value condition rated the course as less interesting than those who did not receive such information. Additionally, a 3-way interaction emerged between prior experience, utility-value, and gender, such that utility-value did not differentially affect male students as a function of prior experience; however, for female participants, utility-value information predicted greater engagement with the examples and exercises for those with no prior experience with webpage creation, and less engagement for those how had experience creating webpages. Implications of the present results are discussed.

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Ever since Lenny can remember, he has enjoyed learning about geology. He has been to rock shops, has many books on mineral identification, and is the owner of a substantial stone collection. Lenny has a vast number of experiences related to geology. How might these prior experiences affect Lenny if he enrolls in a geology course? One would think that a great amount of prior experience with the topic would almost definitely be beneficial in terms of class performance and motivation to learn the material. How might Lenny's interaction with the course material differ from Tonya's, who has never thought more about a rock than how hard she would have to kick one in order to propel it down the street? This paper intends to focus on the role of prior experience in learning contexts, and how previous knowledge of a topic might influence engagement with instructional materials, and, in turn, motivation and performance.

While results flow plentifully from a deep vein of research regarding prior experience, these results are not always consistent. While some studies suggest that prior experience may predict a more superficial level of engagement when the learner is presented with a familiar task (Fraughton, Sansone, Butner, & Zachary, 2011; Shih, Muñoz, & Sánchez, 2006), others show that the more experienced individuals may actually participate in higher cognitive engagement and persist longer in the task (Orvis, Horn, & Belanich, 2009). Despite these seemingly contradictory findings, one result seems to remain consistent throughout the literature. Prior experience is positively related to the performance of an activity or task.

A widely accepted rationale that sheds light on this relationship was most eloquently stated by Glaser and De Corte in the preface to Dochy's (1992) volume on Assessment of prior knowledge as a determinant for future learning:

> A well-organized and coherent knowledge base initiates inference, conceptualization and the acquisition of principled understanding … a key to developing such an integrated and generative knowledge base is built upon the learner's prior knowledge. (p. 1)

More simply stated, individuals with prior experience possess knowledge of task-related material that provides an existing framework into which they can incorporate new information (Arbuckle, Banderleck, Harsany, & Lapidus, 1990; Bransford & Johnson, 1972; Pearson, Hansen, & Gordon, 1979; Shapiro, 2004; Willoughby, Walker, Wood, & Mackinnon, 1993). Rather than starting from scratch, these individuals are able to pick up where they last left off and integrate new information with the knowledge and skills they already possess. This allows individuals to use more automated thinking, which may free up resources that can be delegated to other tasks, such as searching the material for new/interesting information (Chi, Glaser, & Rees 1982), compared to novice individuals who only hope to grasp the basic introductory material.

Schutz, Drogosz, White, and Distenfano (1998) demonstrated the positive relationship between prior experience and performance in a beginning-level statistics course. Students who reported greater experience with mathematics on the first day of the course earned higher grades at the end of the course when compared to their less experienced counterparts. These results replicated findings of the relationship between prior experience with math and performance in many previous studies (Elmore, Lewis, &

Bay, 1993; Elmore & Vasu, 1980, 1986; Feinberg & Halperin, 1978; Presley & Huberty, 1988; Woehlke & Leitner, 1980). Baxter and Oatley (1991) also replicated the positive effect of prior experience in the domain of spreadsheet creation; those users who had previous experience with spreadsheet creation were able to interact with the spreadsheet software more effectively and perform the given task better than those without prior spreadsheet experience. In addition, it has also been shown that as prior experience increases, the strength of its relationship with performance becomes stronger (Alexander, Kulikowich, & Schulze, 1994).

Prior Experience Can Predict the Way Students Interact With Material

Other differences between novice and experienced individuals in terms of learning and learning strategies have been documented by various researchers. Shih et al. (2006) followed students who either did or did not have prior experience with information and computer technology (ICT) tools through a web-based course. The more experienced ICT students were better able to organize their work in the online classroom, visited fewer pages during the different lessons, and spent less time working through the course material. Previous experience using ICT tools did not predict students' assessment of the course, however, with experienced and inexperienced students rating the course equally favorable. While this study did not demonstrate any negative outcomes associated with differential use of the course material, other studies have looked further into the effects of differential engagement and produced results with notable implications.

Last, O'Donnell, and Kelly (2001) examined 12 students equally divided into groups of 6 that either had or did not have previous experience using hyperlinks to navigate through a computer-based lesson. Results suggested that those students with prior experience felt more comfortable navigating through the material and skimmed the content, skipping around the pages, in search of information they did not already know. Conversely, those without prior experience felt as if they were going to get lost while trying to navigate, and for the most part, tried to follow the structure of the material as it was laid out. Up until this point, it seemed that prior experience may have allowed some students to take “shortcuts” while engaging with the lesson material, but did not alter students’ view of the material itself. However, researchers applied one additional manipulation to a subset of students in an attempt to activate performance goals. One group was given worksheets with questions to which they were required to find the answers while working through the material. This goal activation seemed to yield different affective responses for those with and without prior experience, such that novices became increasingly frustrated in their attempt to find the answers, and only seemed to “accidently” stumble across the correct material. No such negative affective responses were displayed by those with prior experience.

These findings seem particularly relevant to traditional educational settings where an emphasis is normally placed on performance. The mere fact that assignments and exams are embedded within the evaluative context of a classroom is likely to evoke some degree of performance related goals (Anderman & Maehr, 1994; Hidi & Harackiewicz, 2000). While this motivating force may not significantly affect important outcomes (e.g., interest and performance) for those with prior experience related to the subject material, goal activation has the potential to be detrimental for the less experienced.

A rich literature has focused on the role of achievement goals in predicting motivation and performance (Ames, 1992; Dweck, 1986; Harackiewicz et al., 1998;

Nicholls, 1990). Goal type (mastery or performance) and goal orientation (approach or avoidance) have been shown to be predictive of certain motivational and performance outcomes. Performance-approach goals tend to be positively associated with performance, and mastery-approach goals positively predict interest. Conversely, performance-avoidance goals are negatively associated with performance as well as interest (Elliot, 2008). Although achievement goal orientation is often thought of as an individual difference that a person brings into a task with them, it is possible to manipulate the type as well as orientation of potential performance goals (Barron & Harackiewicz, 2001; Elliot & Harackiewicz, 1996; Harackiewicz & Elliot, 1993) in certain situations, resulting in similar motivational and performance outcomes. The results from Last et al. (2001) indicate a relationship between prior experience and achievement goals that should be taken into consideration when creating various learning situations where the learner knows that their work is going to be evaluated.

Prior Experience Can Predict Interest

Not only do more experienced individuals possess a firm foundation on which to continue building, but it has been shown that prior experience provides benefits in the form of motivational factors such as interest (Alexander, 1997; Hidi & Renninger, 2006; Kintsch, 1980; Renninger, 2000) and positive expectancy beliefs (i.e., confidence about being able to learn/perform) (Orivs et al., 2006, Orvis, Orvis, Belanich, & Mullin, 2007). Durik and Matarazzo (2009) showed that, compared to novice students, those with more experience with biology not only scored higher on a quiz containing questions about fungus after a short lesson, but were also more interested in coming back for another lesson in the future. In addition to prior experience, students also rated how complex they found the lesson material to be. Perceived complexity of the material moderated the relationship between prior experience and interest in that greater complexity was related to higher interest for the knowledgeable, but hurt interest for more novice students.

These results lend support to the idea that especially, in terms of complex material, possessing an initial framework within which to integrate related information has positive motivational implications. Such findings have been widely replicated and are supported by studies in many diverse domains such as physics, (Alexander et al., 1994), learning about educational psychology (Murphy & Alexander, 2002), playing video games (Orvis, Horn, & Belanich, 2008; Orvis et al., 2007), learning in PC-based instructional environments (Brinkerhoff & Koroghlanian; 2005; Patterson, 1999; Shih et al., 2006), and statistics (Schutz et al., 1998).

While it seems that experienced individuals may have distinct advantages over the less practiced, research suggests that there may be instances where approaching a task as a novice has its own advantages. Wood and Lynch (2002) found that when participants were introduced to a new product, compared to those with no prior knowledge of the product, those with prior knowledge learned less new information. Additionally, Orvis et al. (2008) found that novice video game players increased their performance at a faster rate than those with gaming experience. Although more experienced players still performed better than novices, these new players were able to see a more dramatic increase in their ability, compared to experienced players, and rated their game-playing self-efficacy just as high as those with much more experience. Similar results were reported by Leung (2008) when he had students who were either experienced or inexperienced with music complete a music composition lesson. While inexperienced students started out with lower levels of many motivational and conceptual deficits compared to experienced students, at the end of the lesson, these novices had significantly increased their perceptions of self-competence, as well as their perceived value of music composition, and their intrinsic interest in the task. Experienced students showed no such increases.

The research covered thus far ultimately provides valid rationale for taking students' prior experience with the subject material into consideration when performance is of concern. Rather than being simply an indicator of success, however, prior experience can change the way one interacts with instructional material. Subsequently, behavioral and cognitive engagement, as we shall see, has its own complex relationship with performance, as well as motivational, affective, and evaluative responses, namely, interest.

Why Is Interest Important?

Though it seems obvious that experiencing interest while performing a task is a "good thing," is interest really as important an outcome as performance? One might ask the question, "as long as I'm doing well in a class, does it really matter if I'm interested in the subject material?" Research has shown that when performing an interesting task, individuals engage the task for a longer period of time, learn more quickly, and will choose that task over others (Alexander, Jetton, & Kulikowich, 1995; Lepper & Henderlong, 2000). In addition, when individuals are motivated by individual interest, they are more likely to think about the task after it is completed or if it has been interrupted, and would choose to perform the task again if given the opportunity (Krapp & Fink, 1992; Renninger, 2000).

Clearly, interest plays a key role in terms of motivation. The expectancy-value theory of motivation (Eccles et al., 1983; see Eccles, 2005, for review) suggests that we are motivated to pursue goals that we think we can achieve (expectancy) and those that we feel are important for one reason or another (value). As either expectancy or value (or both) increase, the probability of achieving our goal increases as well (Bandura, 1997; Pintrich & Schunk, 2002). When a challenge is presented during the pursuit of the goal, expectancy and value in large part determine the likelihood that we will either persevere or extinguish. At this point, interest might evolve into a critical factor rather than simply an important one in the pursuit of a set goal. Research shows that people will generally not carry on doing tasks that they find uninteresting. However, what happens if there is a boring or uninteresting task that we need to accomplish because it holds great value?

Self-Regulation of Motivation Model

The Self-Regulation of Motivation Model (SRM) (Sansone & Thoman, 2005) suggests that once a person becomes engaged in an activity, maintaining a certain level of interest is important, in order to sustain their motivation to reach their goal. Sometimes the activity is intrinsically interesting and maintaining motivation is an easy task; however, sometimes we have to take on a task that does not appear to be very stimulating. It is in these instances that self-regulating our own interest becomes very important. If the value of obtaining the desired goal is high enough, it may be necessary to create our own interesting experience in order to continue performing the task long-term. Sometimes all that is needed is a reminder about why the task is important (utility-value). Sometimes in the interest of goal attainment, the task itself must be altered to increase interest, and thus perseverance.

While it is important for individuals to regulate their own motivation while engaged in a task, one reason that individuals might not exert the extra effort to create a more interesting experience could be a lack of motivation to learn the material (goals-defined motivation). In a series of studies, researchers found that adding reasons (e.g., helping others; health benefits) to value a tedious task (copying letters) encouraged students to engage in behaviors that made the task more interesting (e.g., varying how they copied the letters). This ultimately led students to persevere in the task for longer periods and to express interest in engaging in the task again in the future (Sansone, Wiebe, & Morgan, 1999; Sansone, Weir, Harpster, & Morgan 1992). These results provide an example of how affording adequate reasons to value an activity can result in positive motivational outcomes by spurring an individual to use strategies that in turn create a more interesting experience (experience-defined motivation). These alterations to the task make it more likely that one will stick with the task long enough to reach the final goal.

Other studies have yielded similar results supporting the addition of utility-value as a means to increase motivation to engage in an activity (Deci, Eghrari, Patrick, & Leone, 1994; Harackiewicz et al., 1998; Mitchell, 1993; Ross, 1983). Recent studies have uncovered more complex relationships between utility-value and an individual's task-related self-competence. Hulleman, Godes, Hendricks, and Harackiewicz (2010) found that prompting students to generate their own utility-value beliefs pertaining to a new learning task was most beneficial for interest and performance in those with who perceived themselves as less competent. Durik, Shechter, Noh, Rozek, and Harackiewicz (2014), however, found that providing students with predefined utility-value was most beneficial for those who felt more competent. For those who began with lower perceived competence, in contrast, the utility-value information was associated with lower interest.

The SRM model (Sansone & Thoman, 2005) provides an additional explanation for the positive effects of added utility-value, in that it suggests that adding reasons to value a task could potentially lead to better motivational outcomes because they encourage engaging in the activity in more interesting ways. This explanation suggests that while the additional reason to value the task results in enhanced patterns of engagement, it is the engagement itself, rather than the reasons alone, which predicts the positive outcomes.

Due to the relationship between interest and prior experience, there is a distinct possibility that relationships also exist between prior knowledge and the *regulation* of one’s own interest; one study that hints at this possible relationship was conducted by Jeon, Moon, and French (2011). Researchers asked students to write math story problems, giving no instruction on what story content should contain or how the problems should be organized. Those students who had higher mathematical knowledge going into the task (assessed by looking at grades in previous math courses) proceeded to write more creative and intriguing problems, compared to students with less mathematical knowledge. This result is interesting in that while all students were able to write logical story problems, those students who had mastered the mathematics embedded within the stories chose to become more creative with the narratives they composed. Although the researchers did not manipulate possible reasons to value writing story problems, nor did they directly measure interest, the SRM Model (Sansone & Thoman, 2005), would suggest that actions taken by experienced students (e.g., engaging in more creative writing) may have facilitated the regulation of students' own interest while performing the task.

Regulating Motivation When Learning Online

The online classroom environment seems to be a perfect place to examine self-regulation processes. When students enroll in an online course, it is left up to them to decide when and how they interact with the course material, suggesting that successful completion of the course will require at least some level of self-regulation. The online classroom is also becoming an increasingly relevant topic of study as many colleges and universities are moving towards boosting their volume of cyber-based classrooms. Although online learning has been widely adopted by secondary educational institutions, several obstacles have been noted by key academic advisors, not the least of which is a lack of students' self-regulatory abilities. Because of the online classroom's contemporary and theoretical relevance, Sansone and colleagues have turned to this platform in order to expand the applicability of their theory-driven model.

In an initial study by Sansone et al. (2013), researchers had students work on a 90-minute online introduction to HTML lesson. Before they began the lesson, students were assigned to one of three conditions. In the first condition, students were given no information pertaining to the value of learning HTML programming (no value added). In the other two conditions, students were either told about how HTML programming could be relevant to their personal, or to their professional, lives (utility-value added). As students navigated through the lesson, they were presented with opportunities to engage with interactive examples and exercises that illustrated the effects of changing different lines of HTML code. Students had the choice of using these examples/exercises or of bypassing them in order to continue with the lesson. Results suggested those students who were reminded of the possible utility-value for HTML (personal or professional) chose to engage the examples/exercises at a higher level, compared to those students who were given no utility-value information. Findings also indicated that higher levels of engagement with these examples/exercises were related to greater interest in HTML programming and better quiz scores at the end of the lesson.

Role of Prior Experience

Given the need to take prior experience into consideration, in a subsequent paper Fraughton et al. (2011) further examined the role of students' prior experience with web design. They found in general that, although those with experience used the optional examples/exercises less frequently than those without experience, the experienced students who tended to use the optional material more still benefited from their engagement in terms of motivational and performance outcomes. Further, the experienced students who received additional utility-value information used the examples/exercises more, compared to experienced students who did not receive the added utility-value. In addition to prior experience, perceived task-specific self-competence was examined, and prior experience continued to predict engagement over and above perceived competence. Thus, although prior experience is related to perceived competence, the effects for prior experience in this study do not seem to stem from a boost in perceived competence. These results suggest that, while in some cases having prior experience may lead to behavior (i.e., lower degree of engagement with examples/exercises) that results in diminished motivational and performance gains, there are changes (or enhancements) that can be made to certain aspects of a task (e.g., the addition of utility-value) that have the potential to temper this effect. Furthermore, in this instance, students did not expect to be evaluated on their performance.

The studies by Sansone, Fraughton, Butner, and Zachary (in revision) and Fraughton et al. (2011) begin to provide a foundation for understanding the relationships between utility-value, task engagement, interest, performance, and prior experience; however, the paradigm utilized potentially created an experience for students that diverged from an actual online course. For example, while the lesson was designed to replicate one that a student might see in an actual online course, it is possible that students' goal orientations were not activated in a way similar to what would be seen in a real classroom. Had the lesson been framed in an explicitly evaluative context, goals that students adopted while immersed in the lesson may have been altered, resulting in effects that could ripple down to engagement with the lesson material, and ultimately to performance and interest. Additionally, while 90 minutes is an adequate time to capture initial ratings of interest, performance, and engagement patterns, it is difficult to generalize these findings to a semester-long course.

While the insights gained from these studies are invaluable, they can only begin to benefit students if they can be successfully implemented into curriculum by educators. Therefore, it is imperative that this potential disconnect between findings in the lab and possible parallel relationships within a virtual classroom be addressed by introducing similar utility-value enhanced elements into an online course and studying students' interactions with the material, their performance, and motivation to continue learning about the subject in the future. Additionally, understanding how prior experience relates to student engagement and outcomes throughout the 4-month duration of the semester (and not just after students' first 90 minutes of material) could be beneficial in terms of keeping both experienced and novice students engaged throughout the duration of the class.

Taken together, the literature discussed thus far identifies prior experience as a critical element in the context of learning tasks and activities. These findings also hint at the possibility that prior experience's relationship with engagement, performance, and motivational factors (e.g., interest) could differ as a function of whether or not students are concerned with doing well. For example, information that there will be a quiz at the end of the lesson would likely shift students' goal-orientations in a performance-based direction (vs. learning-based), resulting in attempts to learn only the material that will aid performance, rather than that which they find interesting. This may result in effects that are more negative for inexperienced students in terms of interest, as students with prior experience likely already feel that they will perform well, and can spend time searching for other information that they find interesting or have not learned previously.

Gender

Although manipulating the utility-value of learning certain information is something that can be done relatively easily, other factors have the potential to influence motivation to pursue a goal. One that is not particularly easy to adjust is gender. Research has shown that individual knowledge in certain domains reliably predicts gender differences in academic achievement and persistence (Ackerman, Bowen, Beier, & Kanfer, 2001; Rolfhus & Ackerman, 1999). Specifically in the domains of science, technology, engineering, and mathematics (STEM), a wider gender gap exists in that significantly more males pursue STEM careers compared to females (Ceci, Williams, & Barnett, 2009).

Ackerman, Kanfer, and Beier (2013) followed high school graduates throughout their college careers until graduation. AP exam scores for these students in various STEM areas were obtained. The researchers were able to show that those students who successfully completed three or more STEM AP courses (with a score of 3 or above on the AP exam) showed significantly greater STEM persistence compared to those who either did not take the same AP courses or who failed to perform adequately on the exams. Of the 25 students followed who had completed three or more AP STEM exams, only 7 were female. These results suggest that while greater knowledge pertaining to STEM fields leading into college was related to obtaining a STEM degree for both men and women, significantly fewer women were either previously engaged in STEM environments, or not performing up to standard, compared to men.

A number of studies have attempted to pinpoint explanations for this gender difference, producing an abundance of reasons why women are underrepresented in STEM domains. Diekman, Brown, Johnston, and Clark (2010) found that a significant predictor of interest in STEM careers for women was the perception that STEM careers fail to support communal goals. This relationship still held strong even after taking perceived self-competence in science and prior experience into account. In addition, Morgan, Isaac, and Sansone (2001) found that women were more likely than men to report people-oriented (wanting to work with and help others) reasons for their career choices, while men were more likely than women to report extrinsic reward (salary, status) reasons. It was also found that both males and females were likely to report careers in physical/mathematical sciences as affording less opportunity for social interaction than other careers (e.g., education, social services); however, men tended to rate STEM careers as more interesting, and women tended to rate interpersonal careers as more interesting. Other research (Varma, 2007) has credited factors such as early socialization differences between males and females for the gap. Still, others have found a strong link between one's sense of belonging in STEM domains and the desire to pursue such careers in the future Good, Rattan, and Dweck, (2012).

One common link between all of these factors revolves around the widespread stereotype that males perform better in math and science, and therefore are better suited for careers in STEM. Children are exposed at early ages to various stereotypes supporting the idea that boys are good at math and girls are not. Even if children do not grow up explicitly subscribing to this stigma, the mere knowledge that the stereotype exists can persist in producing negative outcomes for females in STEM classes. Not only can these negative effects come about through the process of stereotype threat (e.g., simply activating a stereotype in a member of a stigmatized group) (e.g., Davies, Spencer, Quinn, & Gerhardstein, 2002; Smith & White, 2002; Spencer, Steele, & Quinn, 1999; Wheeler & Petty, 2001), but also through the way teachers and instructors interact with students. While often unintentional, teachers may behave in ways that reaffirm this stereotype such as devoting more time to male students (e.g., self-fulfilling prophecy).

Several studies have suggested ways in which to reduce, or "inoculate" this stereotype threat. In such countries as Malaysia, large numbers of women have made their careers in computer science. This more proportionate distribution is fostered widely by the absence of computer science being perceived, or "stereotyped," as a more "masculine" domain (Lagesen, 2008). Because the status quo does not reflect that of other cultures, females feel as if they belong in the field. Additionally, Solnick (1995) showed evidence that those women who attend coed colleges are more likely to drop out of STEM majors than are women who attend all female colleges. Hall and Sandler (1982) defined the coed STEM classroom as a "chilly climate" that drives women out of some fields and is detrimental to their ability to learn. These results suggest that characteristics of the classroom such as equal gender distribution and a sense of belonging can positively influence motivation to pursue a career in STEM.

All of these examples taken together illustrate not only differences in the proportion of males and females pursuing STEM degrees and careers, but also the idea that males and females might have differing experiences while learning in STEM classrooms. While the "Western" coed college biology course may result in a "warm" positive experience for males, it appears that the climate for females may be, on average, several degrees cooler, creating further disparity between the number of males and females pursuing careers in STEM fields.

In 1988, Kersteen, Linn, Clancy, and Hardyck began asking the question of whether prior experience with computer programming would yield positive effects in terms of performance in a computer science course for both males and females. Unfortunately, their sample size of females who had any prior experience with computer programming was too small to detect any moderating effects of gender. Today, while males and females are still disproportionate in terms of computing experience, there are a greater number of females from which to collect data.

It is important to consider the potential differences in the effects of prior experience as a function of gender. While a male and female student may have taken similar STEM courses in high school, the nature of their individual experiences with the material could have differed, resulting in distinctive effects later on related to their prior experiences. It is likely that if females do have a more negative perception of their prior experiences with STEM, they may be less likely to engage with STEM related material later on, compared to males.

STUDY 1

Study 1 builds upon the results found by Fraughton et al. (2011) by including the activation of performance goals for a subset of participants, thereby clarifying the role of prior experience when performance goals are active during a 90-minute lesson. With the addition of performance goal activation, several unique relationships between prior experience, utility-value, and performance goal activation were expected to emerge. Information that one's performance is going to be evaluated has shown to be beneficial for those with prior experience in the domain, but detrimental for those without prior experience (Last et al., 2001); thus, it is expected that performance goal activation will lead to different patterns of engagement with lesson material for those with and without prior experience designing webpages. Utility-value is expected to further moderate this effect such that the addition of utility-value will positively affect lesson engagement for all but those participants with no prior experience and activated performance goals. This is because it is expected that these students will be too overwhelmed by the new material and the added stress of evaluation that they will not be able to absorb the utility-value information.

Given the possibility that gender could be related to variability in prior experiences with webpage creation, participants' gender is expected to moderate any positive effects of prior experience, such that males would be the primary beneficiaries of any positive effects. For example, it is possible that females with prior experiences might look more like students with no prior experience, in terms of engagement with lesson material.

Method

Participants

Participants (*N* = 279 participants (61% female, mean age = 22.9) enrolled in the study in order to receive credit for their Psychology course. They were randomly assigned to one of 4 conditions in a 2 (no utility-value vs. utility value information) by 2 (No mention of quiz vs. forewarning of quiz) factorial design. These participants were expected to represent the population of roughly 33.5% of college students who enroll in at least one online class during their college career (Allen & Seaman, 2014).

Procedure

A brief description was posted on the undergraduate Psychology subject pool explaining the study as a chance to help researchers improve online learning by working on and evaluating an online HTML programming lesson. Participants who were interested signed up for the study and were contacted by a research assistant via email and asked to fill out an online survey before coming into the lab. The online survey consisted of background and individual difference measures. Once participants completed the online survey, they were asked to sign up for a specific date and time to complete the in person portion of the study.

Upon arrival at the lab, participants found what appeared to be a multipurpose computer lab, similar to other student-use computer labs one campus. Separate workstations and computers near the back of the lab were divided by partitions and allowed up to 4 participants to be working simultaneously, although individually. Participants were greeted by a research assistant disguised as a “lab attendant” who worked at a desk near the front of the lab. The participant was asked to sign in for the proper experiment, after which the research assistant assigned them a computer and workstation. Participants were told that the "lab attendant" could not help them with specific questions they might have about the study, as they were not involved with the study but simply worked in the computer lab, although they could help should problems arise with the computer (e.g., the computer froze or the participant exited the lesson by accident). Participants were then told that they could take short breaks to use the bathroom or get a drink if needed, but that if they did leave their computer to be sure to place a "computer in use" sign (found by the side of their screen) in front of it so that someone else would not come in and take their spot. The research assistant then started the prelesson questionnaire for the participant and the rest of the instructions for the study appeared on the computer screen. After starting the prelesson survey, the research assistant went back to his or her desk behind a partition.

After being left alone at the computer, all participants read a message describing the study. Participants were reminded that they would be working on an online lesson and providing feedback in order to help improve the quality of online learning at the university. Participants were told that they would have 90 minutes to work on the lesson and assignment, after which the postlesson evaluation would appear. Finally participants were reminded that they were allowed to take short breaks to visit the restroom or to get a drink if needed, but that they should remember to place the "computer in use" sign in front of their monitor in order to insure that someone did not come in and start using their computer.

After reading this message, participants were directed to a second page of instructions that introduced the HTML lesson. At this point, participants were presented with one of four different messages that constituted our conditions

Participants in the added utility-value conditions were told that the examples/exercises in the lesson would illustrate how they could apply basic HTML skills to an organization's or a business' webpage, and/or their own personal webpage. As an additional boost to the utility-value manipulation, participants were also asked to select from a list the three top reasons why it would be useful for them to learn HTML programming. Those who did not receive the utility-value manipulation read, instead, that the examples/exercises in the lesson would illustrate how they could apply the basic HTML skills that they were about to learn, and they were asked to select three courses from a list of possible courses for which it would be most important for the university to implement an online version.

After reading the initial introduction to the lesson (which either did or did not contain utility-value information), participants in the quiz forewarning conditions read that at the end of the lesson they would be taking a quiz that would allow the experimenters to compare their performance to others. They were also told that they would be able to compare their scores to other students who had taken the quiz.

When participants had finished reading the manipulation page, they were then directed to a prelesson questionnaire. The questionnaire consisted of two main parts. They first completed a quiz about the instructions they had just read. Questions helped to emphasize certain aspects of the instructions we wanted to make sure participants did not miss (e.g., questions assessing time limit, which types of examples/exercises they would be working with). If participants answered any of these questions incorrectly, they were asked to answer the question again to insure that they understood the instructions. Finally, participants were asked to complete a short questionnaire assessing their initial expectations for the lesson (e.g., anticipated interest, anticipated difficulty, etc.). Upon completion of this questionnaire, the questionnaire page closed and the lesson was launched. Participants had 90 minutes total to read the instructions and complete the lesson and the lesson assignment.

The introduction to HTLM programming lesson that was used was adapted from several lessons that students in the actual HTML programming class found most helpful and interesting. Sections teaching different skills such as text positioning, table creation, inserting images and hyperlinks, creating textboxes, and creating forms were included. These concepts were presented on the main lesson page that participants were expected to read, as well as in the interactive examples and exercises that students could use if they chose to do so.

The examples and exercises could be accessed by clicking on a button positioned on the main lesson pages, and would open up in a new window. Upon opening up an example or exercise, participants were presented with sample HTML code that was consistent across conditions. Participants could then click on another button that would open up a new window and model the actual webpage that the sample code would create. Further, participants had the option to manipulate the sample code, and then model the changes to see how they affected the way the webpage looked. If participants made any errors in their coding when they modified the sample code, an error message would appear to let them know exactly where they had gone wrong. Participants could then fix the error and try to model again. Examples and exercises were available for each different concept taught in the lesson; however, participants had the option of whether or not to use the examples/exercises, and further, how much they wanted to engage the examples/exercises.

Measures

Measures of Individual Differences

Prior Webpage Creation Experience

In order to account for participants' prior experience with web design and computer programming, they were asked in the online survey before coming into the lab to indicate to what extent they had previously worked within each domain. Participants rated their experience with webpage creation on a 1 (no prior experience) to 4 (have created web pages professionally in HTML) scale.

Demographics

Demographic information such as gender, age, ethnic background, English fluency, religious affiliation, and major were collected

Measures of Initial Expectations

After receiving the manipulation, but before beginning the lesson, measures of participants' expectations were collected. These questions served as initial assessments of interest ("How interesting do you think this lesson will be?"), anticipated difficulty ("How difficult do you think the lesson will be?"), anticipated performance on the task ("How well do you think you will do on this task?"), competence value ("How important is it for you to do well on the lesson today?"), utility value ("How useful do you think learning the material in this lesson will be?”), the personal importance of learning the information (“How important is it to you to learn the material in this lesson?”), and how autonomous they felt about working on the lesson (“Working on this lesson is something I wish to do”). These items were assessed using a 1 (not at all/none at all) to 5 (very much) scale. These questions were used in order to assess whether or not the condition manipulations created different lesson expectancies (see Ainley & Patrick, 2006 a for discussion of reliability and validity of these one-item measures).

Outcomes

Lesson Engagement Behaviors

Usage of the optional examples/exercises was assessed in three different ways. At the first level, for each example and exercise, we assessed whether participants simply accessed (opened) an example/exercise, and if so, whether or not they accessed that same example/exercise more than once (coded “0” if not accessed; “1” if accessed once; “2” if accessed more than once). Scores for each example/exercise were then aggregated across the lesson for a total score (Degree Accessed). Once participants opened the examples/exercises window, they then had two further options. They could click on a "model" button that would open a second window showing how the sample code affected the web page, and/or they could click on the "change" button that would open a second window allowing them to manipulate the sample code and model the effects of those changes on the web page. As a measure of the second or midlevel of engagement, therefore, we assessed whether or not participants clicked on the "model" button, and if so, whether they modeled the same example/exercise multiple times (coded and aggregated the same as “access”) (Degree Modeled). As a measure of the third and highest level of engagement, we assessed whether or not participants clicked on the "change" button, and if so, whether or not they manipulated/modeled the same example/exercise more than once, aggregated across the entire lesson (coded and aggregated the same as “access” and “modeled”) (Degree Manipulated/Modeled). Measurement of these behaviors allowed us to determine whether different conditions elicited different engagement behaviors. Possible scores ranged from 0 to 30.

<u>Interest</u>

Interest in the lesson after completion was assessed by participants’ summed ratings of agreement with five items using a 5-point scale ranging from *strongly disagree* (*1)* to *strongly agree* (*5)* (e.g., “I would describe this lesson as very interesting”; possible range 5-25; alpha = .92).

<u>Learning</u>

A short multiple choice quiz was given after the lesson had closed. The quiz was comprised of questions dealing with specific concepts and problems that had been taught in the lesson (e.g., “What happens when you place a <BR> tag at the end of a line of text?”; “How many rows in a table will the following line of code create?”). These questions were drawn from questions used in an actual online HTML course, but we took care to ensure that each question corresponded to points brought up in the laboratory lesson. Participants had the chance to score from 0 up to 11 points on this quiz.

Results and Discussion

Preliminary Analysis

To begin, we examined the effects of the manipulation of utility-value and quiz forewarning on the items measured after exposure to these manipulations, but prior to beginning the lesson (as well as participants' prior experience creating webpages), to determine if our conditions effectively altered participants' expectations for the lesson. A regression model was created that included three unweighted effects codes for the manipulation of utility-value: *Value Added* (+1 for Value Added, -1 for No Value Added), *Quiz Forewarning* (+1 for Forewarning of Quiz, -1 for No Forewarning), and *Prior Experience creating webpages* (+1 for Prior Experience, -1 for No Prior Experience), along with the interactions between the variables (three 2-way interactions, one 3-way interaction). Of the participants who answered the question assessing prior experience with webpage creation, 81 of 167 female participants had prior experience creating, compared to 54 of 105 male participants.

When the item assessing how important participants thought it would be to do well on the lesson was regressed on the model, the overall model was significant (F(7, 267) = 2.633, p = .012, R^2 = .065. Both the provision of utility-value and quiz forewarning significantly and positively predicted importance of doing well (t(274) = 2.037, p = .043, b = .127, 95% *CI* [.004, .250], and t(274) = 3.217, p = .001, b = .201, 95% *CI* [.078, .324], respectively).

When the item assessing how useful participants thought the material in the lesson would be, the overall model failed to reach significance; however, there was a significant interaction effect between prior experience creating webpages and quiz forewarning

($t(274) = 2.117$, $p = .035$, $b = .119$, 95% *CI* [.008, .230]) such that participants who had prior experience creating webpages and also received the quiz forewarning expected the lesson material to be more useful than those without experience, and those who did have experience, but did not receive the quiz forewarning (see Figure 1).

When the item assessing how difficult participants thought the lesson would be was regressed on the model, the overall model failed to reach significance, and none of the main effects or interaction effects approached significance. However, when the item assessing how well participants thought they would do on the lesson was regressed on the model, the overall model was significant ($F(7, 267) = 2.106$, $p = .043$, $R^2 = .052$), and the main effect for prior experience creating webpages was significantly and positively associated with how well participants thought they would do ($t(274) = 2.483$, $p = .014$, $b = .106$, 95% *CI* [.022, .190]). Additionally, there was a significant interaction between prior experience and the provision of utility-value ($t(274) = -2.385$, $p = .018$, $b = -.102$, 95% *CI* [-.186, -.018]), such that when utility-value information was provided, those with and without prior experience creating webpages expected to do equally well; however, when participants were not provided with utility-value information, those without prior experience creating webpages expected to do worse, and those with webpage creation experience expected to do better, compared to when they were provided with utility-value information (see Figure 2).

Finally, when anticipated interest was regressed on the model, the overall model was significant ($F(7, 267) = 3.746$, $p = .001$, $R^2 = .089$). The main effects for quiz forewarning and prior experience creating webpages were both significantly and positively associated with anticipated interest ($t(274) = 2.180$, $p = .03$, $b = .133$, 95% *CI*

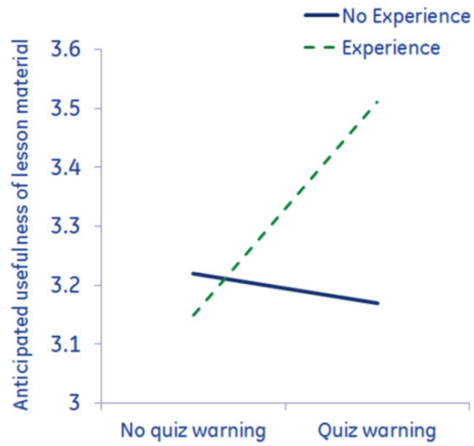

Figure 1. Interaction between quiz forewarning and prior experience creating webpages predicting anticipated usefulness of lesson material.

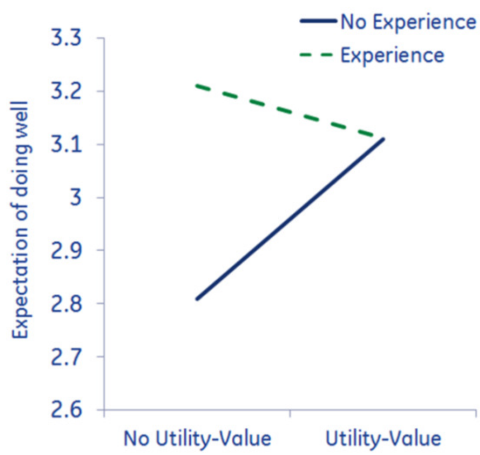

Figure 2. Interaction between utility-value information and prior experience creating webpages predicting expectation of lesson performance.

[.013, .253], and $t(274) = 2.469$, $p = .014$, $b = .151$, 95% *CI* [.031, .271], respectively). There was also a significant interaction between the provision of utility-value information and quiz forewarning, such that those who did not receive a quiz forewarning reported slightly higher anticipated interest when utility-value information was provided, compared to when it was not available. However, when participants were notified that there would be a quiz, those who did not receive utility-value information reported greater anticipated interest, compared to those who did receive utility-value information (see Figure 3).

The interaction effect between prior experience creating webpages and quiz forewarning was also significant ($t(274) = 3.358$, $p = .001$, $b = .205$, 95% *CI* [.085. .325]) such that only those participants who had prior experience creating webpages *and* received the quiz forewarning reported greater anticipated interest, compared to those without experience, and those with experience, but who did not receive the quiz forewarning (see Figure 4).

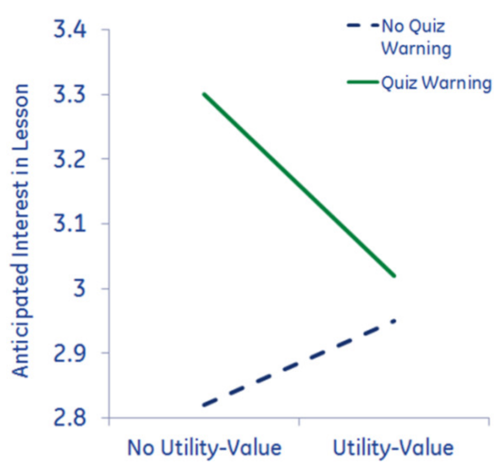

Figure 3. Interaction between quiz forewarning and utility-value predicting anticipated interest.

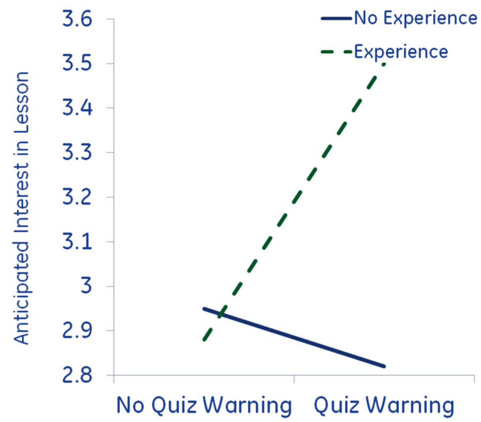

Figure 4. Interaction between quiz forewarning and prior experience creating webpages predicting anticipated interest.

Taken together, these results suggest that the utility-value manipulation may not have had as strong of an effect on participants' initial perceptions of the lesson overall; however, those participants who did not have prior experience creating webpages expected to do better on the lesson when they were presented with utility-value information, compared to those who were not. Utility-value also appeared to decrease participants' expectations of how interesting the lesson was going to be, when combined with the forewarning of a quiz at the end of the lesson. The quiz forewarning condition appeared to boost expectations of how interesting and useful the lesson material was going to be, but only for participants who had prior experience creating webpages.

Main Analysis Overview

The same regression model used in the preliminary analyses predicting expectations of the lesson was used to examine whether the Utility-Value conditions, Quiz Forewarning conditions, and Prior Experience affected engagement with the examples and exercises. The model included three unweighted effects codes for the manipulation of utility-value: *Value Added* (+1 for Value Added, -1 for No Value Added), *Quiz Forewarning* (+1 for Forewarning of Quiz, -1 for No Forewarning), and *Prior Experience Creating Webpages* (+1 for Prior Experience, -1 for No Prior Experience), as well as the interactions between the variables (three 2-way interactions, one 3-way interaction).

Engagement Behaviors

When Degree Accessed and Degree Modeled were regressed on the model, the overall models were not significant, but the main effect of quiz forewarning did significantly predict engagement ($t(266) = 2.123$, $p = .035$, $b = 1.081$ and $t(266) = 2.189$, $p = .029$, $b = 1.182$, respectively). No other main effects or interaction terms approached significance. When Degree Manipulated/Modeled was regressed on the model, the overall model was not significant, nor were any of the main effects. The interaction between Prior Experience and Quiz Forewarning, however, was significant ($t(266) = 2.017$, $p = .045$, $b = 2.008$), such that warning participants who there would be a quiz at the end of the lesson was associated with greater manipulation and modeling of sample HTML codes for those who had prior experience creating webpages, and with less manipulation and modeling for those who did not have prior experience. Conversely, in the absence of the quiz forewarning, those with prior experience were less likely to manipulate and model the sample codes relative to those without prior experience (see Figure 5).

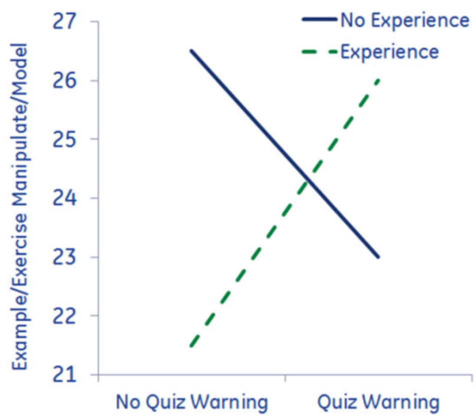

Figure 5. Interaction between quiz forewarning and prior experience creating webpages predicting example/exercise manipulate/model.

Lesson Outcomes

When postlesson interest was regressed on the model, the overall model was not significant. Although no main effects approached significance, there was an interaction between prior experience and quiz forewarning similar to that found for Degree Manipulate/Model ($t(263) = 2.005$, $p = .046$, $b = .569$), such that Quiz Forewarning was associated with greater interest for those with prior experience and lower interest for those without that experience (see Figure 6).

When postlesson quiz score was regressed on the model, the overall model was not significant. Although no main effects approached significance, there was an interaction between utility-value and quiz forewarning ($t(267) = -1.989$, $p = .048$, $b = -.244$) such that, when the forewarning of the quiz was not given, the addition or omission of utility-value made no difference. However, when the forewarning of the quiz was presented, those who were provided with utility-value information did worse on the quiz than those who did not receive utility-value information (see Figure 7).

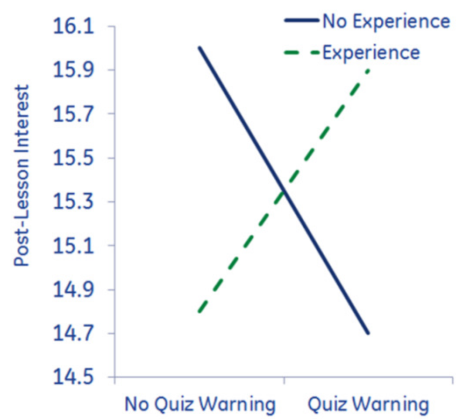

Figure 6. Interaction between quiz forewarning and prior experience creating webpages predicting post-lesson interest.

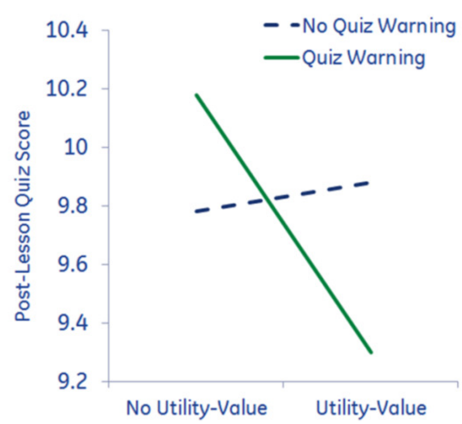

Figure 7. Interaction between utility-value and quiz forewarning predicting post-lesson quiz score.

In order to explore the relationships between engagement behaviors and lesson outcomes, degree accessed, degree modeled, and degree manipulated/modeled were added to the model. When postlesson interest was regressed on this model, the prior significant interaction between prior experience and quiz forewarning was no longer significant. However, the overall model was significant ($F(10, 259) = 6.262$, $p = .000$), and the main effect for Example/Exercise Manipulate/Model was positively and significantly related to interest ($t(259) = 4.475$, $p = .000$, $b = .082$).

These findings suggest modeling and manipulating the examples and exercises mediated the relationship between the prior experience/quiz forewarning interaction and interest at the end of the lesson. In order to confirm this relationship, bootstrapped biased corrected confidence intervals were utilized. Significance testing can be generated by showing that zero is outside the confidence interval range. Results show that the interaction between prior experience and quiz forewarning had a significant indirect effect, through its effects on manipulating/modeling the examples and exercises, on postlesson interest (95% CI: $.0159 < .1448 < .2958$). These results suggest that when participants had prior experience creating webpages and received the information that there would be a quiz at the end of the lesson, they were more likely to manipulate/model the examples and exercises, which resulted in greater interest at the end of the lesson. The same was true for participants who did not have prior experience creating webpages, but were not warned that there would be a quiz at the end of the lesson.

When postlesson quiz score was regressed on the model, the overall model was significant ($F(10,263) = 6.480$, $p = .000$), and the main effects for Example/Exercise Model, and Manipulate/Model were positively and significantly related to quiz score ($t(263) = 3.324$, $p = .001$, $b = .052$, and $t(263) = 4.551$, $p = .000$, $b = .036$, respectively. The interaction effect between utility-value and quiz forewarning was no longer significant. Bootstrapped biased corrected confidence intervals were utilized to check for possible mediation effects of modeling and manipulating/modeling the examples/exercises between the interaction of utility-value/quiz forewarning and quiz score. For both modeling and manipulating/modeling, the confidence intervals spanned across zero, indicating that no mediation was at work in this model.

Anticipated Interest as a Mediator

These analyses suggest several different relationships between the prior experience/quiz forewarning interaction and lesson engagement, as well as postlesson interest. Additionally, the same interaction predicted similar effect patterns on participants' anticipated interest in and usefulness of the lesson material. Bivariate correlations were run showing the relationship between anticipated interest in, and usefulness of the lesson material, lesson engagement, and postlesson interest. Results show that both degree manipulate/model and postlesson interest were positively related to anticipated interest (r = .131, p = .029, and r = .442, p = .000, respectively). Post-lesson interest was significantly and positively related to anticipated usefulness (r = .29, p = .000). It is possible that the effects of the prior experience/quiz forewarning interaction on lesson engagement and postlesson interest occurred via its relationship with anticipated interest.

In order to examine this path, bootstrapped biased corrected confidence intervals were utilized once again. Results show that the interaction between prior experience and quiz forewarning had a significant indirect effect, through its effects on anticipated interest, on manipulating/modeling the examples and exercises (95% *CI*: .0469, 1.2796). The degree that participants manipulated/modeled the examples/exercises failed to mediate the relationships between anticipated interest and interest at the end of the lesson. However when postlesson interest was regressed on a model that included the study manipulations, prior experience, their interactions, anticipated interest, and degree manipulated/modeled, the overall model was significant (F(10, 259) = 12.010, p = .000, R^2 = .317). Both anticipated interest and degree manipulated/modeled were significantly and positively related to postlesson interest (t(269) = 5.28, p = .000, b = 1.615, 95% *CI* [1.013, 2.217], and t(269) = 6.518, p = .000, b = .096, 95% *CI* [.067, .125], respectively).

These findings suggest that participants who had prior experience creating webpages and who received forewarning of a quiz had greater anticipated interest in the lesson material. Further, simply expecting to be interested in the lesson material led to greater engagement with the examples and exercises and greater interest at the end of the lesson (independent of the degree to which participants manipulated/modeled the examples and exercises) (see Figure 8).

Gender

In order to examine the potential relationship between gender and prior experience as predictors of lesson engagement, a model was created that included the unweighted effect codes for prior experience creating webpages, provision of Utility-Value, Quiz Forewarning, and Gender (coded +1 for Male, -1 for Female), and the interactions between these variables (four main effects, six 2-way interactions, three 3-way interactions, and one 4-way interaction).

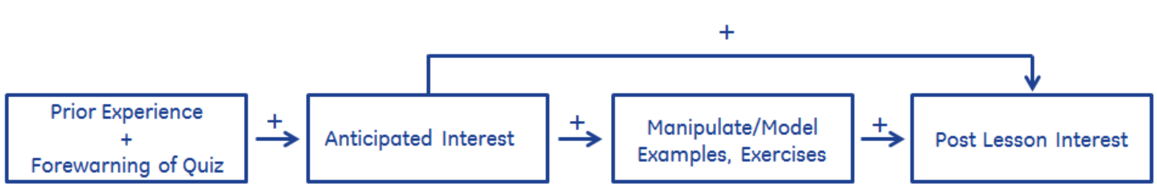

Figure 8. Effect of the interaction between prior experience and forewarning of a quiz at the end of the lesson on post-lesson interest thru anticipated interest and engagement with example/exercises

When Example/Exercise Access was regressed on the model, the overall model was not significant. The main effect of quiz forewarning positively and significantly predicted Degree Accessed ($t(270) = 2.216$, $p = .028$, $b = 1.160$). When Example/Exercise Model was regressed on the model, the overall model was not significant. The main effect of quiz forewarning significantly and positively predicted Degree Modeled ($t(270) = 2.204$, $p = .028$, $b = 1.220$), and gender significantly predicted Degree Modeled, such that male participants Modeled Examples and Exercises significantly more than female participants ($t(270) = 2.203$, $p = .028$, $b = 1.215$).

Finally, when Example/Exercise Manipulate/Model was regressed on the model, the overall model was not significant; however, gender significantly predicted Degree Manipulate/Model such that male participants manipulated/modeled the examples and exercises significantly more than female participants ($t(270) = 2.072$, $p = .039$, $b = 2.087$) The interaction between prior experience and quiz forewarning was once again significant ($t(270) = 2.219$, $p = .027$, $b = 2.245$). However, no other interaction terms approached significance.

Postlesson interest and quiz score were regressed on the model. Neither model was significant overall, nor were there any significant main or interaction effects.

STUDY 2

Study 1 confirms that participants who had prior experiences creating webpages did indeed have different expectations of the lesson, and in turn interacted with the lesson differently, when they were warned there would be a quiz at the end of the lesson, compared to those who did not have prior experience. These results suggest that in an actual classroom setting, where performance goals are regularly made salient, students who have prior experience creating webpages may start off with a distinct advantage, merely because they anticipate that the course will be more interesting than their classmates who have not been exposed to webpage creation.

As these results come from a laboratory, where the majority of students do not plan to pursue their education in designing webpages, and have a very limited amount of time to interact with the lesson material, it is important to show that the same effects exist in an actual classroom. Thus, a second study was carried out in a semester-long online introductory webpage creation course. In this environment, similar results to Study 1 were expected. Over the course of the semester, however, it is possible that differences between those with and without prior experience creating webpages could diminish, as the beginners start to catch up with the more experienced students. Be examining the data in a longitudinal manner, it will be possible to understand whether any advantages afforded to more experienced students persist throughout the semester.

Method

Participants

Participants (N = 73, 27% female, mean age = 25.4) were students who enrolled in the online course “Creating Interactive Web Content” during Fall 2012 and Spring 2013 semesters. Participants who signed up for the study were sent a $10 check after submitting responses to questionnaires at the end of each section of the course in addition to the initial background questionnaires (up to $50.00 total). Students who completed all four sections of the course were entered into a drawing to win one of three $100.00 gift cards to the university bookstore.

Procedure

Several days before each semester began, the instructor of the course sent out an email to all students registered for the course letting them know how they could obtain a password to log onto the class website. The email mentioned the study, and contained a copy of the study informed consent. The email also let students know that they would have a chance to sign up when they clicked the link to get their password, but also let them know that they needed to sign up for the study before they logged onto the class website for the first time. Because our manipulations took place at the very beginning of the course, if students logged on to the class before signing up for the study, they were not able to participate. Finally, the email gave students the option of opening and reading the informed consent right then. If they chose to learn more about the study, they were presented with the following recruitment statement:

> You are invited to participate in a wonderful opportunity to help scientists create better online learning experiences! We are looking to identify the different patterns that students use when working in online classes. To do this we will periodically be asking you to answer some short questionnaires at various times

> while you are working on this course. You will be compensated for your time. This is completely separate from the course, and your instructor will not know who is in the study, nor will he see any of your individual responses. Thank you for your time. It will take less than 5 minutes to learn more details about this study and sign up. NOTE: once you have logged into the course for the first time, you will not be able to participate in this study, so please take a few minutes now to learn more.

If students chose not to learn more about the study when they read this initial course email, they were presented with the recruitment statement again when they clicked on the link to procure their course password. If a student chose to participate in the study, their student ID number was automatically sent to the study database. Students who opted into the study were sent a link to an online questionnaire similar to the prestudy questionnaire utilized in Study 1 (assessing individual differences). Upon completion of the questionnaire, students could then log into the class. If a student agreed to take part in the study, but failed to complete the prestudy survey before logging into the course for the first time, they were subsequently removed from the study.

Once students logged onto the course website for the first time, they were randomly assigned to one of two conditions. In the control condition, students were presented with a page that welcomed them to the class and informed them of general ways that the information they would learn in the course could be applied (similar to the no-utility value information control condition in Study 1). Conversely, students in the utility-value added condition were presented with specific applications for the information they would learn in the class pertaining to their personal and professional lives. Additionally, these students were also given a list of many different applications they could apply with the information they would learn in the class (e.g., "Make existing websites look more professional," "Survey clients about satisfaction with customer service," "Add hyperlinks and images to blogs.) Similarly to Study 1, students were then asked to pick the three applications on the list that would be most useful for them to learn. Students were also given the option to choose "other," and then specify what that "other" application was. Due to technical errors, a subset of students assigned to the utility-value condition received the generic application information during the first section of the course (identical to control condition), but the more specific utility-value information for each section after that. Apart from this information, students in both the no utility value and utility-value information conditions were directed to the exact same course content throughout the semester. The error involving the presentation of the utility value information for the initial section occurred during both semesters although the reason for the error varied between semesters. During the first semester, students who were assigned to the utility-value condition were not presented with the manipulation during the first section of the course if they signed up for the study using an alternative format of their student identification number. Entering in a student ID number beginning with either "U" or "0" would allow students to log onto the course; however, students who entered their ID number starting with "0" rather than "U" were not correctly presented with the manipulation during the first section of the course (due to a program coding error). During the second semester, the programming code that automatically matched students up with the condition they were assigned was not working properly during the first few days of the semester; therefore, students assigned to the utility-value condition who logged on in the first few days of class were not given the correct manipulation until after the first section was completed. There were other students, however, who were assigned to the utility-value condition who did not log on until after the code was repaired; thus, they received the correct manipulation from the beginning of the class.

At the end of each course, section (four sections total), quizzes occurred as part of the course material, presented as study guides. When the quiz was submitted, for all students who had signed up to participate in the study, a window popped up asking them, as part of the study, to fill out a questionnaire assessing interest in, perceived self-competence in, and value of learning the material in the completed section. Then, as the next section began, those participants in the utility-value condition were again presented with the list of possible applications for the material they would learn. They were also reminded of the choices that they selected as most useful for them to learn at the beginning of the prior section. They were then asked to again select the three most useful applications for them now. Students were then able to continue with the next section of the course.

Measures

Measures to Control for Background and Individual Differences

Questionnaires were presented via the prestudy questionnaire and were the same questions assessing individual differences as Study 1.

Outcomes

Lesson Engagement Behaviors

Lesson engagement with the optional examples/exercises was assessed similarly to those in Study 1 (Degree Accessed, Degree Modeled, and Degree Manipulated/Modeled). Scores were aggregated as a function of section, so each participant had four measures of each (e.g., Degree Manipulated/Modeled Section 1; Degree Manipulated/Modeled Section 2; etc.)

Interest

Interest was measured after each of the four course sections by participants' summed ratings of agreement with five items using a 5-point scale, ranging from *strongly disagree* (*1)* to *strongly agree* (*5)* (e.g., "I would describe this section as very interesting"; possible range 5-25; alpha = .92). Each participant had four measures of interest, one corresponding to and collected after each of the four sections of the course.

Learning

Learning at the end of each course section was assessed using section quizzes, resulting in four quiz scores for each participant. Quiz scores did not count toward grades in the course, but they were framed as study guides.

Results and Discussion

Main Analysis Overview

Data were analyzed using repeated-measures mixed-effects linear growth models with a variance component covariance structure and random intercepts (models with random slopes were attempted but failed to run). Models were run predicting engagement behaviors, lesson interest, and quiz score. These models included the fixed effects of Utility-Value (+1 for Value Added, -1 for No Value Added), prior experience with creating webpages (+1 for Prior Experience, -1 for No Prior Experience), and time (Time0, Time1, Time2, and Time3, each corresponding to the four separate sections of the course). As some participants did not receive the Utility-Value manipulation until the beginning of the second section of the course, Utility-Value was added as a time-varying covariate such that sections where there was no Utility-Value information were coded -1, and sections where Utility-Value information was added were coded +1. Interactions between Utility-Value, prior experience, and time were also included in the model (three 2-way interactions and one 3-way interaction).

Engagement Behaviors

When the model was run predicting Example/Exercise access, there was a significant main effect for time (B = -10.572, SE = 1.021, p < .000, 95% CI [.0-12.588, -8.557]), such that, over time, participants accessed the examples and exercises less frequently. No other main or interaction effects approached significance. When the model was run predicting Example/Exercise Model, there was a similar significant negative main effect for time (B=-11.286, SE=.867, p < .000, 95% CI [-12.997, -9.576]). Finally, when the model was run predicting Example/Exercise Manipulate/Model, there was again a significant negative effect of time (B=-8.430, SE=.705, p < .000, 95% CI [-9.829, -7.038]) as well as a significant main effect of Utility-Value addition (B=-5.272, SE=2.138, p=.014, 95% CI [-9.487, -1.057]), such that those who received the Utility-Value information Manipulated/Modeled the examples and exercises less than those who did not receive Utility-Value information. No other main or interaction effects approached significance. These results suggest that overall, as the course went on, students engaged less (to all degrees) WITH the examples and exercises. Additionally, when presented with Utility-Value information, students tended to be less likely to engage the examples and exercises at the highest level (Manipulate/Model) relative to those who did not get the Utility-Value information.

Lesson Outcomes

When the model was run predicting lesson interest, there was a main effect of Utility-Value (B=-1.086, SE=.485, p = .026, 95% CI [-2.043, -.129]), such that those who received the Utility-Value information rated the lessons as less interesting than those who did not receive the Utility-Value information, similar to the negative effect of Utility-Value on engagement. No other main or interaction effects approached significance. When the model was run predicting quiz scores, there was a main effect of time (B=-.270, SE=.113, p = .018, 95% CI [-.493, -.046]), such that quiz scores fell over the course of the semester.

In order to examine the relationship between engagement behaviors and lesson outcomes, each type of engagement behavior (i.e., access, model, manipulate/model) was added separately to the original model. When the models were run predicting interest, main effects for Access (B=.0221, SE=.010, p = .028, 95% CI [.002, .042]), Model (B=.025, SE=.011, p=.029, 95% CI [.003, .047]), and Manipulate/Model (B=.030, SE=.012, p = .016, 95% CI [.005, .054]) were significant, such that as engagement levels increased, interest in the lessons also increased. Taken together, these results suggest that interest may have been indirectly affected by Utility-Value through its negative effects on engagement with the examples and exercises. When the models were run predicting quiz score, there were no significant main or interaction effects, suggesting that levels of engagement with the examples and exercises did not influence end of section quiz scores.

Gender

It is possible that male and female students' prior experiences with webpages creation could differ (e.g., could be more positive for males, compared to females); thus, any potential effects of prior experience may not emerge until the variance explained by gender is controlled for, and its interactions with other variables in the model are explored. To do this, gender was added to the model (+1 for male, -1 for female), along with all of its interaction terms. Eleven out of the 16 female participants had prior experience creating webpages, compared to 31 out of the 43 male participants. The low number of female participants suggests that there could be power issues in detecting gender effects. Post-hoc power analysis revealed the power of effects involving gender/prior experience ranged from .5 to .6.

When the model was run predicting Example/Exercise Access, the significant main effect for time remained (B=-10.930, SE=1.162, p<.000, 95% CI [-13.700, 2.100]). Additionally, there was a significant 3-way interaction effect between Utility-Value, prior experience, and gender (B=4.313, SE=2.038, p=.036, 95% CI [.290, 8.336]), such that the addition of Utility-Value for males, regardless of prior experience, resulted in decreased Access of the examples/exercises, compared to those who did not receive the Utility-Value information. For females, the Utility-Value information led to greater engagement for those with no prior experience creating webpages, but lower engagement for those who had prior experience. There was no difference in engagement between females with and without prior experience for those who did not receive the Utility-Value information (see Figure 9).

When the model was run predicting Example/Exercise Model, the main effect for time remained (B=-11.335, SE=.986, p<.000, 95% CI [-13.280, -9.390]). After controlling for variation related to students' gender, a significant main effect of prior experience creating webpages emerged (B=-7.976, SE=3.162, p =.029, 95% CI [-15.123,

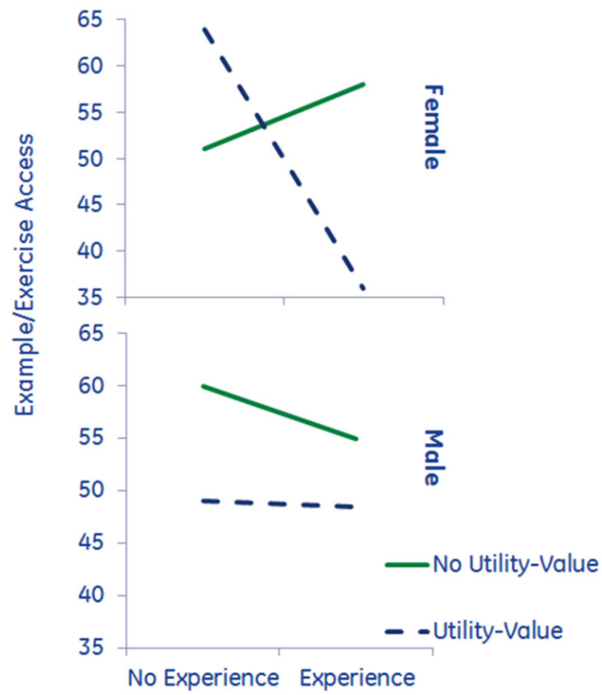

Figure 9. 3-way interaction between Utility-Value, prior experience, and gender predicting Example/Exercise Access.

-.829]), such that those with prior experience modeled the examples and exercises less than those without prior experience, overall. The 2-way interaction between time and prior experience also reached significance (*B*=2.142, *SE*=.986, *p* = .044, 95% *CI* [.108, 7.332]). A test of simple slopes revealed a marginal negative effect of prior experience during sections 1 and 2 (*B*=-3.638, *t*=-1.386, *p* = .063, 95% *CI* [-7.382, .198]; *B*=-3.234, *t*=-1.160, *p* = .069, 95% *CI* [-7.218, .201], such that those with prior experience modeled somewhat less than those without prior experience during the first two sections of the course. This marginal difference disappeared during the third and fourth sections of the course (see Figure 10). Finally, similar to Access, the 3-way interaction between Utility-Value, prior experience, and gender was significant (*B*=3.720, *SE*=1.831, *p* = .044, 95% *CI* [.108, 7.332]) (see Figure 11).

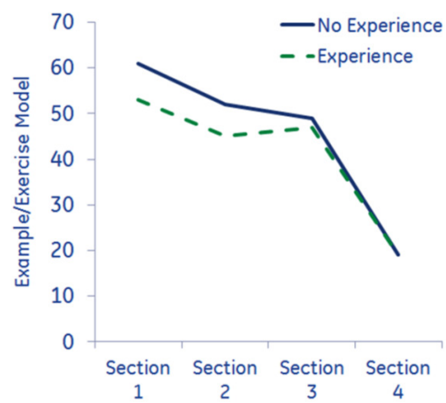

Figure 10. 2-way interaction between time and prior experience creating webpages predicting Example/Exercise Model.

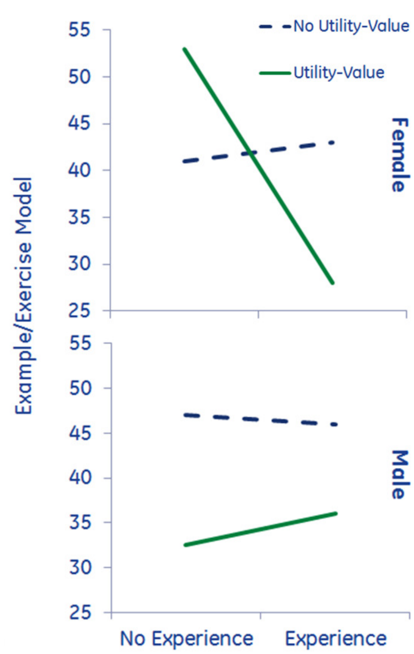

Figure 11. 3-way interaction between Utility-Value, prior experience, and gender predicting Example/Exercise Model.

When the model was run predicting Example/Exercise Manipulate/Model, the main effects for time (B=-8.938, SE=.785, p<.000, 95% CI [-10.488, -7.388]) and Utility-Value (B=-4.733, SE=2.335, p=.044, 95% CI [-9.337, -.128]) were significant, as before. Additionally, after controlling for variation related to students' gender, there was a significant 2-way interaction between time and prior experience (*B*=2.074, *SE*=.785, *p*=.009, 95% *CI* [.524, 3.624]), indicating that the decrease over time of manipulating and modeling the examples and exercises was particularly true for students who did not have prior experience creating webpages (see Figure 12).

Additional models were run predicting section interest and quiz scores that added Example/Exercise Access, Model, and Manipulate/Model individually, as well as their interactions with gender. For interest, the main effects of Utility-Value remained for all models (Model+Access: *B*=-1.122, *SE*=.482, *p*=.021, 95% *CI* [-2.073, -.172]; Model+Model: *B*=-1.084, *SE*=.481, *p*=.025, 95% CI-[2.034, -.135]; and Model+Manipulate/Model (*B*=-1.004, *SE*=.483, *p*=.039, 95% *CI* [-1.957, -.051]). Additionally, the main effects for Example/Exercise Access (*B*=.027, *SE*=.011, *p*=.020, 95% *CI* [.004, .049]) and Model (*B*=.030, *SE*=.013, *p*=.019, 95% *CI* [.005, .056]) were significant, such that the more students accessed and modeled the examples and exercises, the more interest they had in the material. The main effect of Manipulate/Model failed to reach significance. None of the interaction effects between engagement and gender approached significance, suggesting that the way students engaged the examples and exercises did not differentially affect interest in the course material for males vs. females.

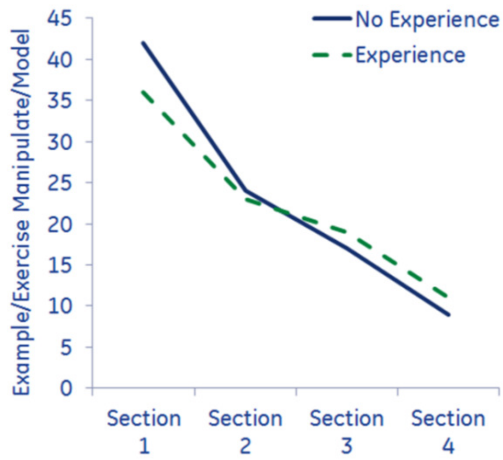

Figure 12. 2-way interaction between prior experience and time predicting Example/Exercise Manipulate/Model.

Lesson Outcomes

When the model that included gender was run predicting end of section interest, there was a significant main effect for Utility-Value (*B*=-.993, *SE*=.484, *p*=.041, 95% *CI* [-1.947, -.039]), such that those who received the Utility-Value information rated the course sections as less interesting than those who did not receive the addition of Utility-Value. No other main or interaction effects approached significance. When the model was run predicting section quiz scores, none of the main or interaction effects approached significance.

When the models including engagement behaviors and their interactions with gender were run predicting quiz scores, there were no significant main or interaction effects. These results indicate that although the way students engage the lesson material is related to interest, these specific behaviors are not indicative of performance on the quizzes, regardless of gender.

GENERAL DISCUSSION

Taken together, results from Studies 1 and 2 indicate complex relationships between prior experience, utility-value, lesson engagement, and lesson outcomes. Consistent with prior research (Fraughton et al, 2011; Sansone et al., in revision), higher levels of engagement with examples and exercises was predictive of greater interest in the lesson/course section. However, across studies, the addition of utility-value was often not related to engagement behaviors or lesson outcomes, and where relationships did exist, utility-value actually predicted decreased engagement/interest in the lesson material. When effects of prior experience were found, they were often moderated by other factors, such as anticipation of a quiz, utility-value, and gender. Additionally, results found in the laboratory setting did not always correspond to results found in an actual online course. Because of this, it is important to examine the inconsistent data in order to understand why these findings might diverge.

Prior Experience

As expected, Study 1 did not reveal any main effects of prior experience creating webpages on engagement with the examples and exercises, suggesting that when only considering prior experience (without considering the context of expected performance evaluation), students did not engage the lesson material differently. The results from Study 2, indicated, however, that students' prior experience predicted differential engagement with the examples and exercises at the start of the semester, although this difference disappeared as the course progressed. Because Study 2 occurred within an actual class where performance evaluation was expected by all participants, the results suggest that experience might have different effects depending on the salience of performance evaluation. In fact, although no main effects of prior experience emerged in Study 1, when the potential for evaluation is also considered, differences did appear for those with and without prior experience.

Quiz Forewarning

Data from Study1 indicated that prior experience creating webpages had differential effects on engagement with examples and exercises, depending on whether or not participants also received the forewarning of a quiz at the end of the lesson. These results were expected, considering prior research (Durik & Matarazzo, 2009; Last et al., 2001) that suggests those with prior experience enjoy working on challenging material more than those who are unfamiliar with the same material. As the quiz information were expected to serve as a proxy for the salient presence of performance goals sparked by engaging in an actual course (Barron & Harackiewicz, 2001; Elliot & Harackiewicz, 1996; Harackiewicz & Elliot, 1993), it was predicted that students in Study 2 who had prior experience creating webpages would look similar to those with prior experience in Study 1 who had also received the quiz information. Data from Study 2, however, were not consistent with this hypothesis, as students with prior experience started the course modeling the examples and exercises less than those who did not have prior experience. In this case, the participants' behavior was more similar to the participants in Fraughton et al. (which had no expected performance evaluation). This suggests that in the actual class, performance evaluation might not have been as salient during the course as it was in the one session of the lab in Study 1.

Gender and Utility-Value

Another stark difference between the findings from Study 1 and Study 2 were differential effects of gender on lesson engagement and lesson outcomes. Study 1 showed a significant main effect of gender, such that males demonstrated higher levels of engagement, compared to females, regardless of prior experience creating webpages. Study 2, however, suggests a far more complicated relationship between gender, prior experience, and engagement, when utility-value is also considered. It appears that differences between male and female engagement with lesson material may depend their perceived value of the subject matter. While the provision of utility-value information was related to decreases in high-level engagement for males, regardless of prior experience creating webpages, utility-value information actually benefited females with no prior experience.

Lesson Engagement and Outcomes

Though Studies 1 and 2 yielded somewhat varied results, the relationship between lesson engagement and lesson interested remained consistent. Just as Sansone et al. (in revision) and Fraughton et al. (2011) reported, increased engagement (particularly higher level engagement) resulted in greater interest in the lesson material. This finding is important, as it shows that the relationship holds over an extended period of time (a semester), and does not just apply to a limited, one-time activity.

Comparing Studies 1 and 2

Several explanations are possible for the inconsistencies between Studies 1 and 2, including the population of students sampled. In Study 1, our sample came from the Psychology Department subject pool. Data suggested that the positive results of the prior experience/quiz forewarning combination were due to increased anticipated interest in the lesson material. As the students from Study 2 were willing to enroll in a semester-long course in webpage design, it is likely that they already had some interest - even if they had no prior experience with webpage design. Therefore, students with and without experience did not anticipate different levels of interest in the course before it began. Additionally, some students may have enrolled in the course because knowledge of webpage creation was required for their work, resulting in different motivations at the onset of the course (interested in web design vs. requirement for work). Because we did not measure these expectations before the class began, we cannot directly test these possibilities. However, these findings suggest that expectations for the class may play a greater role than anticipated, and will be important factors to explore in subsequent studies.

Another possible explanation for the difference in findings could be a failure of the quiz forewarning manipulation to produce the same goal orientation that students in the online course experienced. Although performance goals may be salient while working on material for an actual course (Anderman & Maehr, 1994; Hidi & Harackiewicz, 2000), exams and grades may be particularly salient at the point when that assessment will take place (e.g., near exams). At other times in the course (e.g., near the beginning of the semester or soon after the midterm exam), students may focus more on learning (Ames & Archer, 1988; Dweck, 1986; Hidi & Harackiewicz). The students in the lab had 90 minutes to work on the lesson, and, when warned about the quiz, were working with a purpose to do well on the quiz at the end of the lesson. This acute scenario may not have translated precisely to the classroom, and, therefore, results from Study 1 and Study 2 appear incongruent. Because few studies have tracked student behavior over time in the way we have, the possibility of fluctuating goal foci over time is something that has not been examined in detail, and something that would benefit from further study.

Data from Study 1 suggested that the quiz forewarning had a positive effect on postlesson quiz scores in the absence of the utility-value information, but a negative effect when utility-value information was added. Neither utility-value, nor prior experience significantly predicted quiz scores in Study 2. A notable difference between the quizzes existed, however, was that participants in Study 1 were told that their quiz scores would be used to evaluate them against other students, while students in Study 2, however, were only told that the quizzes would be a useful study guide, and that they would not count towards their grade.

Making salient the evaluative context of the lesson in Study 1 was meant to activate performance goals for the participants in the quiz forewarning condition. It makes sense that this manipulation would affect the goals, and therefore the actions of participants as they progressed through the lesson and the quiz. Knowing that their scores were going to be compared to others may have motivated them to work to obtain a higher score. Conversely, simply presenting the quizzes in Study 2 as a means for students to assess their current knowledge and help them prepare for exams was not expected to put performance at the forefront of students' minds. They may have truly tried to test their knowledge and took the quizzes as seriously as if they were exams, or they could have just clicked through the questions in order to see the answers and use them to study for the exams. We did not ask students about their strategies for taking the quizzes, so understanding their motivation is difficult.

Limitations and Future Directions

Application of the findings from the present studies is complicated, in terms of providing general suggestions to instructors for creating course materials/designs that would benefit a variety of students. The findings by Fraughton et al. (2011) suggested that the provision of utility-value would benefit all students regardless of differences in prior experience. Present results, however, suggest that providing utility-value can actually be detrimental, and in fact, only appears to lead to greater engagement with course material for a specific subset of students enrolled in an actual course (female students with no prior experience designing webpages). Canning and Harackiewicz (2015) suggested that students actually benefitted more when they were both presented with and had to come up with their own utility-value ideas. The more connections the students made between the lesson material and their own lives, the better the outcomes were.

Durik et al. (2015) found that providing utility-value information to students with lower competence led to lower levels of interest in the task. Canning and Harackiewicz (2015) replicated these results, but also showed that self-generated utility-value benefited those with less competence. The present studies provided utility-value information, and gave participants the option of writing in their own ideas as well, but did not necessarily encourage the generation of different ideas. The negative effects of utility-value that were found could have been driven by participants who had lower levels of competence; however, models which included interactions between competency perceptions (initial expectations of doing well on the lesson; how difficult they thought the lesson would be) and utility-value were tested for Study 1, and no significant interactions predicting engagement, interest, or quiz score were found.

In the future, it may be more beneficial to not only provide utility-value information, but to push students to think about the specific ways the material might relate to their own lives. Even though our study failed to find differential effects of utility-value based on competence, prior studies have shown that the combination of explicitly communicated and self-generated utility-value can benefit those who need a boost the most, and at the very least, is not likely to be detrimental.

Both Studies 1 and 2 relied on data collected when participants interacted with webpage coding language. While this material provides ample opportunity to engage the material being taught, it limits the results to only those domains where engagement with the course material would be similar (e.g., mathematics, chemistry, etc). Further studies should be conducted to examine these relationships in courses where ways students interact with the material might be less concrete (e.g., Literature, Psychology, etc).

In Study 2, there was a noticeable disparity between the number of female and male students who had prior experience. Similarly to the difficulties faced by Kersteen et al. (1988), it was challenging to recruit a large number of female students, let alone those who had prior experience in webpage design, which could explain why some effects only emerged once gender was controlled for. That is, there may not have been enough power to fully identify gender differences in the process, although there were suggestions that the variability introduced by gender influenced the results. Thus, in order to fully explore gender differences as they relate to prior experience, a larger sample of female students could be collected.

Conclusion

The present studies provide evidence that prior experience creating webpages can indeed influence the way students interact with course material, and subsequently, interest in that material. Although these relationships are not always straightforward, prior experience does seem to be an important factor to take into consideration when examining students' behavior and perceptions of course material. For introductory courses (e.g., the course Study 2 utilized), students may or may not have had prior experience with the topics to be discussed; however, for, courses that require prerequisites on the same subject matter, ways to enhance engagement and interest in the material for students with prior experiences become essential. While previous findings (Fraughton et al., 2011) found that providing utility-value information resulted in positive outcomes for both novice and experienced students, the present studies failed to provide confirmation of these results. Thus, if provision of utility-value is to be used as a means to increase engagement in a course, effort must be made to encourage students to really ponder the relevancy of the skill being learned to their specific circumstances.

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